PATENT SPECIFICATION

DRAWINGS ATTACHED

1,050,383

1,050,383

Date of Application and filing Complete Specification: March 17, 1964.

No. 11173/64.

Application made in Germany (No. O9320 IXb/30a) on March 27, 1963.

Complete Specification Published: Dec. 7, 1966.

Index at acceptance:—A5 R63; B5 L2

Int. Cl.:—A 61 b 17/14//B 23 d

COMPLETE SPECIFICATION

Instrument for Cutting or Severing a Bone from Within the Bone

We, ORTOPEDIA GmbH, of Kiel—Dietrichsdorf, Salzredder 3, Germany, a German body corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an instrument for cutting or severing bones from within the bones.

Up to now, it has been common practice in surgery to saw or break through a bone from the outside thereof, which measure, however, involved the danger of infection, of shock, of a high loss of blood, or of an injury to vessels, nerves or tendons.

In order to avoid this danger, the invention proposes an instrument designed for an entirely different method of operation namely to cut or sever the bone not from its outside, but to insert a cutting tool through the marrow-cavity, which is first drilled or otherwise provided with a central opening for this purpose, into the interior of the bone, and to apply the tool against the inner wall of the bone.

The invention consists in an instrument for cutting or severing a bone from within the bone, comprising a rotatably driven cutting tool supported by an elongate flexible drive shaft being adapted to be inserted into the interior of a bone through a longitudinally drilled hole, and means adapted to be introduced into the drilled hole together with the cutting tool for urging and laterally displacing the cutting tool in the direction of the periphery of the bone, the said means being actuable from outside the bone.

According to one embodiment of the invention, having a plurality of cutting tools, these tools are movable radially outwardly to a cutting position against the bone wall, being urged by resilient means to this position.

The internal saw may be inserted into the bone in the manner which is known for marrow spikes or nails, i.e. it is introduced into the marrow-cavity of the bone through a small skin puncture being spaced a sufficient distance from the location of the cut to be made. Similarly as in the case of driving in marrow spikes or nails, prior to insertion of the tool the marrow-cavity is enlarged by means of a long marrow-cavity drill to a diameter exceeding that of the saw disc of the internal saw by .04".

The invention will now be described in detail with reference to these preferred embodiments of the invention as shown in the accompanying drawings, wherein:—

Figure 1 is a longitudinal section view through an embodiment of the instrument according to the invention, with the displacement means pivoted outwardly;

Figure 2 is a longitudinal sectional view through another embodiment of the instrument of the invention, with the displacement means pivoted outwardly;

Figure 3 is a longitudinal sectional view through a third embodiment of the instrument according to the invention, with the displacement means spread apart;

Figure 4 is an elevational view of the circular saw disc with the displacement means retracted (insertion position), in section along lines II—II of Figures 1 and 2; and

Figure 5 is an elevational view of the circular saw disc with the displacement means expanded (operational position), in section along lines II—II in Figures 1 and 2.

In the drawings, the invention has been shown in a schematic form only since the exact constructional configuration will be

[*Price 4s. 6d.*]

obvious to an expert from the present disclosure.

The instrument of the invention comprises a small cutting tool such as a circular saw disc 1, the diameter of which approximately corresponds to that of the narrow-cavity of the bone to be severed, and which is attached to the end of a robust elongated rotatable power-transmitting shaft 2 having a length of from 12" to about 16". In the embodiment shown in Figure 1, this shaft comprises a metal wire, preferably a steel wire, whereas in the embodiment shown in Figure 2, a wire or a flexible shaft is used for this purpose. The other end of this shaft 2 may be connected through a clutch (not illustrated) and through a flexible drive shaft (not illustrated, either) to any one of the electric or pneumatic motors commonly used in an operating room.

The shaft 2 extends into a flexible tube 3 which furthermore encloses an elongate power-transmitting element 4 of substantially the same length as the shaft 2, the end of which element 4 adjacent the saw disc is provided with a displacement means in the form of an approximately crescent-shaped lever 5 extending parallel to the saw disc. In the embodiment shown in Figure 1, element 4 and shaft 2 both consist of a metal wire, preferably a steel wire, while a flexible tube coaxially enclosing shaft 2 forms an outer element 4*a* in the embodiments shown in Figures 2 and 3.

Due to its eccentric mounting relative to the saw hub, lever 5 (which is almost completely covered by the saw disc in the sectional view of Figure 4) may be moved a substantial distance out of the circulator contour of the saw disc 1 by rotating shaft 4, as shown in Figure 5, so that the lever presses against one side of the inner wall of the tubular bone and forces the saw disc to the opposite side of the bone wall, so that the bone may be severed at this latter point upon rotation of the saw disc. By rotating the entire instrument about its longitudinal axis, the tubular bone is cut through along its entire circumference although, if so desired, cutting need not be effected right through the bone wall, the remaining portion of the bone wall being broken at a later stage.

Obviously, different cutting tools such as a milling tool, a grinding wheel, or one or more cutters may be used in a corresponding manner instead of the circular saw disc.

In order to allow the lever 5 of the embodiment shown in Figures 1, 2, 4 and 5 to be pivoted outwardly from the tube 3 in a plane crossing the axis of the power-transmitting element 4 and preferably normal to said axis, the element 4 of Figure 1 is bent at 4' in a right angle at its end opposite to the lever or displacing means, and passes out of the tube in radial direction through an elongated hole 8 extending through e.g. about 180° of the periphery of the tube. In the construction of Figure 2, the end of the outer element 4*a* is provided with a pin 4'' extending through said elongated hole. The angular portion 4' or pin 4'' may be provided with an external threading adapted to receive a nut 6 by means of which the element 4, or 4*a* may be secured against the tube 3 in any desired angular position.

Further, the embodiment of Figure 1 includes one or more collars 7 or the like guide means disposed internally of the tube and adapted to guide shaft 2 and element 4 within the tube 3 parallel to the axis of the tube.

In the embodiment shown in Figure 3, the cutting tool preferably comprises three cutting members 1*a* which are arranged respectively at the ends of three tool retainers or holders 5*a* adapted to be spread apart to form an angle with respect to the central axis of tube 3*a* and preferably to be spread apart in radial direction. In this modification, the power-transmitting element 4*a* is not provided about its longitudinal axis as in the embodiments of Figures 1 and 2 in order to move the displacing means out of the rotating axis of the drive shaft towards the wall of the bone, but is shifted by means of a lever 4*b* mounted on one end of the element 4*a* to project through a hole 8*a* in axial direction relative to the other power-transmitting shaft 2*a*, so that, when in the retracted position shown in Figure 3, the element 4*a* allows expansion of the tool holders 5*a* under the action of an expanding means 9*a*, e.g. in the form of three springs. In this case, the elongated hole 8*a* must extend in the direction of the tube axis. Centrifugal force created by rotation of the drive shaft 2*a* together with the expanding means 9*a* urge the cutting members 1*a* to cut into the bone wall.

In the embodiment illustrated in Figure 2 the shaft 2, prior to or during introduction of the instrument into the marrow cavity, may be pushed forward to extend some centimetres beyond the end of the tubular element 4*a*. The flexibility of shaft 2 thus permits the saw disc 1 to be inclined from its rotating axis to contact the bone wall at the desired point of cutting. Displacement of the lever 5 retains the disc in this position and cutting is effected by rotation of the shaft 2.

WHAT WE CLAIM IS:—

1. An instrument for cutting or severing a bone from within the bone, comprising a rotatably driven cutting tool supported by an elongate flexible drive shaft and being adapted to be inserted into the interior of a bone through a longitudinally drilled hole, and means adapted to be introduced into the drilled hole together with the cutting tool

obvious to an expert from the present disclosure.

The instrument of the invention comprises a small cutting tool such as a circular saw disc 1, the diameter of which approximately corresponds to that of the narrow-cavity of the bone to be severed, and which is attached to the end of a robust elongated rotatable power-transmitting shaft 2 having a length of from 12" to about 16". In the embodiment shown in Figure 1, this shaft comprises a metal wire, preferably a steel wire, whereas in the embodiment shown in Figure 2, a wire or a flexible shaft is used for this purpose. The other end of this shaft 2 may be connected through a clutch (not illustrated) and through a flexible drive shaft (not illustrated, either) to any one of the electric or pneumatic motors commonly used in an operating room.

The shaft 2 extends into a flexible tube 3 which furthermore encloses an elongate power-transmitting element 4 of substantially the same length as the shaft 2, the end of which element 4 adjacent the saw disc is provided with a displacement means in the form of an approximately crescent-shaped lever 5 extending parallel to the saw disc. In the embodiment shown in Figure 1, element 4 and shaft 2 both consist of a metal wire, preferably a steel wire, while a flexible tube coaxially enclosing shaft 2 forms an outer element 4a in the embodiments shown in Figures 2 and 3.

Due to its eccentric mounting relative to the saw hub, lever 5 (which is almost completely covered by the saw disc in the sectional view of Figure 4) may be moved a substantial distance out of the circulator contour of the saw disc 1 by rotating shaft 4, as shown in Figure 5, so that the lever presses against one side of the inner wall of the tubular bone and forces the saw disc to the opposite side of the bone wall, so that the bone may be severed at this latter point upon rotation of the saw disc. By rotating the entire instrument about its longitudinal axis, the tubular bone is cut through along its entire circumference although, if so desired, cutting need not be effected right through the bone wall, the remaining portion of the bone wall being broken at a later stage.

Obviously, different cutting tools such as a milling tool, a grinding wheel, or one or more cutters may be used in a corresponding manner instead of the circular saw disc.

In order to allow the lever 5 of the embodiment shown in Figures 1, 2, 4 and 5 to be pivoted outwardly from the tube 3 in a plane crossing the axis of the power-transmitting element 4 and preferably normal to said axis, the element 4 of Figure 1 is bent at 4' in a right angle at its end opposite to the lever or displacing means, and passes out of the tube in radial direction through an elongated hole 8 extending through e.g. about 180° of the periphery of the tube. In the construction of Figure 2, the end of the outer element 4a is provided with a pin 4'' extending through said elongated hole. The angular portion 4' or pin 4'' may be provided with an external threading adapted to receive a nut 6 by means of which the element 4, or 4a may be secured against the tube 3 in any desired angular position.

Further, the embodiment of Figure 1 includes one or more collars 7 or the like guide means disposed internally of the tube and adapted to guide shaft 2 and element 4 within the tube 3 parallel to the axis of the tube.

In the embodiment shown in Figure 3, the cutting tool preferably comprises three cutting members 1a which are arranged respectively at the ends of three tool retainers or holders 5a adapted to be spread apart to form an angle with respect to the central axis of tube 3a and preferably to be spread apart in radial direction. In this modification, the power-transmitting element 4a is not provided about its longitudinal axis as in the embodiments of Figures 1 and 2 in order to move the displacing means out of the rotating axis of the drive shaft towards the wall of the bone, but is shifted by means of a lever 4b mounted on one end of the element 4c to project through a hole 8a in axial direction relative to the other power-transmitting shaft 2a, so that, when in the retracted position shown in Figure 3, the element 4a allows expansion of the tool holders 5a under the action of an expanding means 9a, e.g. in the form of three springs. In this case, the elongated hole 8a must extend in the direction of the tube axis. Centrifugal force created by rotation of the drive shaft 2a together with the expanding means 9a urge the cutting members 1a to cut into the bone wall.

In the embodiment illustrated in Figure 2 the shaft 2, prior to or during introduction of the instrument into the marrow cavity, may be pushed forward to extend some centimetres beyond the end of the tubular element 4a. The flexibility of shaft 2 thus permits the saw disc 1 to be inclined from its rotating axis to contact the bone wall at the desired point of cutting. Displacement of the lever 5 retains the disc in this position and cutting is effected by rotation of the shaft 2.

WHAT WE CLAIM IS:—

1. An instrument for cutting or severing a bone from within the bone, comprising a rotatably driven cutting tool supported by an elongate flexible drive shaft and being adapted to be inserted into the interior of a bone through a longitudinally drilled hole, and means adapted to be introduced into the drilled hole together with the cutting tool

for urging and laterally displacing the cutting tool in the direction of the periphery of the bone, the said means being actuatable from outside the bone.

2. An instrument as claimed in claim 1, wherein the means for urging and laterally displacing the cutting tool is movable from a position for insertion into the drilled hole of the bone, in which position its projection into a plane normal to the direction of insertion of the said means into the bone is within the periphery of the projection of the cutting tool into the said plane, to an operative position in which the cutting tool is displaced from its position of insertion into the bone to a position against the bone wall.

3. An instrument as claimed in claim 1 or 2, wherein the means for urging and laterally displacing the cutting tool comprises a lever means being supported eccentrically of the axis of rotation of the cutting tool, the lever means being pivotable in a plane parallel and adjacent to the plane of rotation of the tool.

4. An instrument as claimed in claim 3, wherein the lever means is crescent-shaped.

5. An instrument as claimed in any one of claims 1 to 4, wherein the force for urging and laterally displacing the cutting tool is applied by a pin from outside the bone upon the means acting on the cutting tool, by means of a flexible member located within a flexible tube surrounding the drive shaft.

6. An instrument as claimed in claim 1, wherein the means for urging and laterally displacing the cutting tool is provided on the rotatable drive shaft itself.

7. An instrument as claimed in claim 6, wherein the means for urging and laterally displacing the cutting tool comprise resilient means biasing the cutting tool against the inside of the bone wall, when in its operative position.

8. An instrument as claimed in claim 7, wherein a plurality of cutting tools is used being movable radially outwards to their cutting position within the drill hole and rotatable around the axis of rotation of the shaft.

9. An instrument as claimed in claim 1, wherein the cutting tool is supported on the resilient means.

10. An instrument as claimed in any of claims 5 to 8, comprising an axially displaceable flexible tube adapted to relieve the means for urging the cutting tool from its introducing position into its operative position and vice versa.

11. An instrument as claimed in claim 5 or 10, comprising means for locking the flexible member or flexible relieving tube, respectively, in a selected position within the radial range of displacement of the tool.

12. An instrument according to any one of the preceding claims, being rotatable around the axis of the hole drilled in the bone.

13. An instrument for cutting or severing a bone from within the bone substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicant(s).

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1966.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

1050383 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

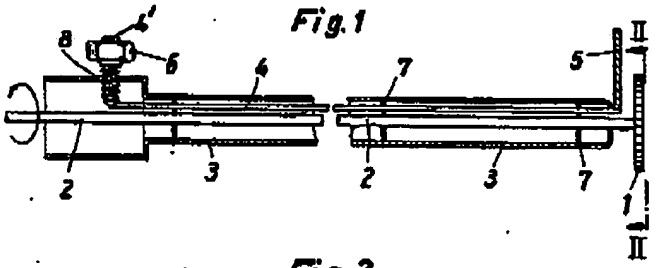

Fig. 2

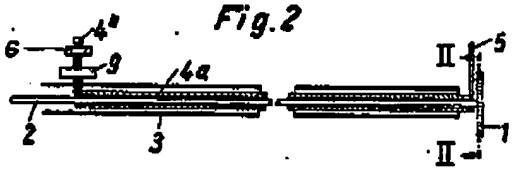

Fig. 3

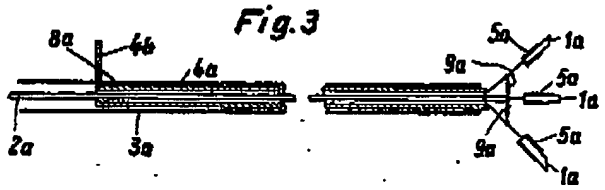

Fig. 4

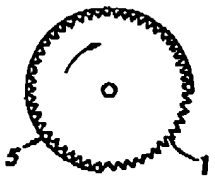

Fig. 5